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On the Smallness of the Dark Energy Density in Split SUSY Models Inspired by Degenerate Vacua

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It is well known that in no-scale supergravity global symmetries protect local supersymmetry (SUSY) and a zero value for the cosmological constant. The breakdown of these symmetries that ensures the vanishing of the vacuum energy density near the physical vacuum leads to the natural realization of the multiple point principle (MPP) assumption, i.e. results in the set of degenerate vacua with broken and unbroken local supersymmetry. We present the minimal SUGRA model where the MPP assumption is realised naturally at the tree-level. In this model vacua with broken and unbroken local supersymmetry in the hidden sector (first and second phases) have the same energy density without any extra fine-tuning. Although hidden sector does not give rise to the breakdown of supersymmetry in the second phase SUSY may be broken there dynamically in the observable sector. Then a positive value of the energy density in the second vacuum is induced which can be assigned, by virtue of MPP, to all other phases including the one in which we live. The total vacuum energy density is naturally tiny or zero in this case. If gauge couplings in the physical and second vacua are the same then the dark energy density depends on the SUSY breaking scale in the physical vacuum only. Assuming Split SUSY type spectrum we argue that the observed value of the cosmological constant can be reproduced if the masses of squarks and sleptons are of order of 10^{10} GeV.

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